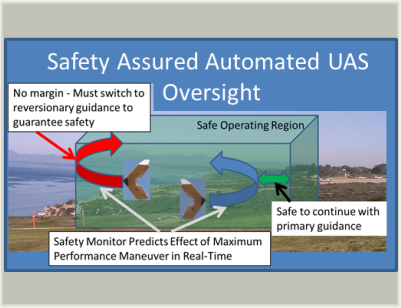
Small Business Innovation Research/Small Business Tech Transfer

Run-Time Assurance for Safe UAS Operations with Reduced Human Oversight, Phase I

Completed Technology Project (2016 - 2016)

Project Introduction

Current Unmanned Aircraft Systems (UAS) operations in the National Airspace System (NAS) rely heavily on human oversight, with the majority of commercial operations currently authorized by the FAA through the Section 333 exemption process restricted to visual line of sight with a single vehicle controlled by an experienced UAS operator. Operation of SUAS may be highly automated, but human oversight is still required to provide a last line of defense against failures, especially those due to errors in the Guidance, Navigation and Control (GNC) system. Oversight of the systems is appropriate because the Verification, Validation, and Certification (V&V/C) activities required to achieve a high software Design Assurance Level (DAL) typically have not been conducted for these systems. In some cases this is because the GNC systems contain elements such as adaptive and learning capabilities that make V&V/C with existing methods difficult or impossible, while in other cases the issue is primarily cost, which can be prohibitive especially for small, low-cost systems. Barron Associates proposes development of automated monitoring capabilities that can assume the low-level monitoring responsibilities currently allocated to humans, enabling safe UAS operations with reduced human oversight. To develop these automated capabilities, the team will build on a rigorous Run-Time Assurance (RTA) framework developed by Barron Associates. Goals of the research effort include (1) building a safety monitor based on the rigorous theory of the RTA framework to enforce geo-fence boundaries for arbitrary vehicles, including fixed-wing vehicles, (2) rapidly advancing the TRL of the technology with a Phase II program that culminates in flight demonstrations, and (3) demonstrating that the RTA framework is a practical and powerful basis that can be used to enable reduced human oversight for a wide range of operating scenarios.



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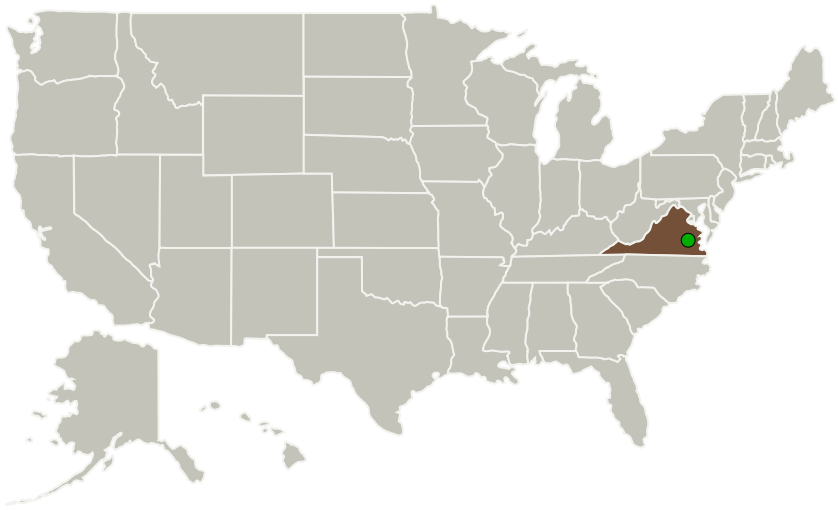
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Barron Associates, Inc.	Lead Organization	Industry	Charlottesville, Virginia
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations
Virginia

Project Transitions

June 2016: Project Start

December 2016: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139890)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Barron Associates, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

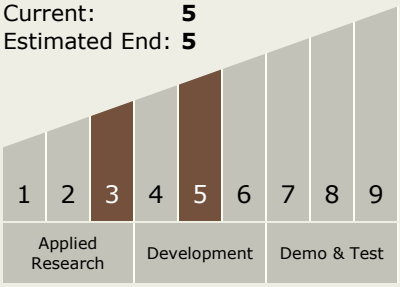
Carlos Torrez

Principal Investigator:

Richard Adams

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



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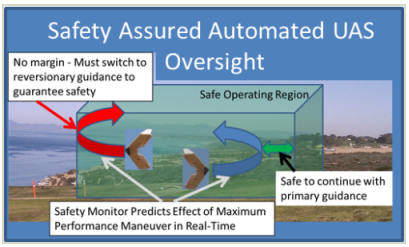
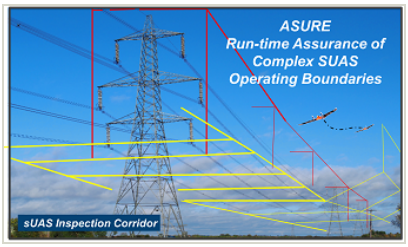
Images



Briefing Chart Image
Run-time Assurance for Safe UAS Operations with Reduced Human Oversight, Phase I *(https://techport.nasa.gov/image/128224)*



Final Summary Chart Image
Run-time Assurance for Safe UAS Operations with Reduced Human Oversight, Phase I Project Image *(https://techport.nasa.gov/image/126251)*

Technology Areas

Primary:

- TX10 Autonomous Systems
  - TX10.2 Reasoning and Acting
    - TX10.2.4 Execution and Control

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System